## Claims

1. A method of performing a fine frequency synchronization compensating for a carrier frequency deviation from an oscillator frequency in a multi-carrier demodulation system (130) of the type capable of carrying out a differential phase decoding of multi-carrier modulated signals, said signals comprising a plurality of symbols (200), each symbol being defined by phase differences between simultaneous carriers (202) having different frequencies, said method comprising the steps of:

determining a phase difference between phases of the same carrier in different symbols;

determining a frequency offset by eliminating phase shift uncertainties corresponding to codeable phase shifts from said phase difference; and

performing a feedback correction of said carrier frequency deviation based on said determined frequency offset.

2. A method of performing a fine frequency synchronization compensating for a carrier frequency deviation from an oscillator frequency in a multi-carrier demodulation system (130) of the type capable of carrying out a differential phase decoding of multi-carrier modulated signals, said signals comprising a plurality of symbols (200), each symbol being defined by phase differences between simultaneous carriers (202) having different frequencies, said method comprising the steps of:

determining respective phase of the same carrier in different symbols;

eliminating phase shift uncertainties corresponding to

codeable phase shifts from said phases to determine respective phase deviations;

determining a frequency offset by determining a phase difference between said phase deviations;

performing a feedback correction of said carrier frequency deviation based on said determined frequency offset.

3. A method of performing a fine frequency synchronization compensating for a carrier frequency deviation from an oscillator frequency in a multi-carrier demodulation system (130) of the type capable of carrying out a differential phase decoding of multi-carrier modulated signals, said signals comprising a plurality of symbols (200), each symbol being defined by phase differences between simultaneous carriers (202) having different frequencies, said method comprising the steps of:

for a plurality of carriers (202) in said symbols (200):

determining a phase difference between phases of the same carrier in different symbols; and

determining a frequency offset by eliminating phase shift uncertainties corresponding to codeable phase shifts from said phase difference;

determining an averaged frequency offset ($f_{offset}$) by averaging said determined frequency offsets of said plurality of carriers (202); and

performing a feedback correction of said frequency deviation based on said averaged frequency offset ($f_{offset}$).

4. A method of performing a fine frequency synchronization

compensating for a carrier frequency deviation from an oscillator frequency in a multi-carrier demodulation system (130) of the type capable of carrying out a differential phase decoding of multi-carrier modulated signals, said signals comprising a plurality of symbols (200), each symbol being defined by phase differences between simultaneous carriers (202) having different frequencies, said method comprising the steps of:

for a plurality of carriers (202) in said symbols (200):

determining respective phases of the same carrier in different symbols;

eliminating phase shift uncertainties corresponding to codeable phase shifts from said phases to determine respective phase deviations; and

determining a frequency offset by determining a phase difference between said phase deviations;

determining an averaged frequency offset by averaging said determined frequency offsets of said plurality of carriers; and

performing a feedback correction of said frequency deviation based on said averaged frequency offset.

5. The method according to claims 1 or 3, wherein said step of determining a phase difference comprises the step of determining a phase difference between phases of the same carrier (202) in symbols (200) which are adjacent in the time axis direction.

6. The method according to claims 1 or 3, wherein said step of determining a frequency offset comprises the step of eliminating phase shift uncertainties corresponding to M-ary phase shifts.

7. The method according to claims 2 or 4, wherein said step of determining respective phases comprises the step of determining respective phases of the same carrier (202) in symbols (200) which are adjacent in the time axis direction.

8. The method according to claims 2 or 4, wherein said step of eliminating phase shift uncertainties comprises the step of eliminating M-ary phase shifts.

9. An apparatus for performing a fine frequency synchronization compensating for a carrier frequency deviation from an oscillator frequency, for a multi-carrier demodulation system (130) of the type capable of carrying out a differential phase decoding of multi-carrier modulated signals, said signals comprising a plurality of symbols (200), each symbol being defined by phase differences between simultaneous carriers (202) having different frequencies, said apparatus comprising:

means (330) for determining a phase difference between phases of the same carrier (202) in different symbols (200);

means (340, 342) for determining a frequency offset by eliminating phase shift uncertainties corresponding to codeable phase shifts from said phase difference; and

means for performing a feedback correction of said frequency deviation based on said determined frequency offset.

10. An apparatus for performing a fine frequency synchronization compensating for a carrier frequency deviation from an oscillator frequency, for a multi-carrier demodulation system (130) of the type capable of carrying out a differential phase decoding of

multi-carrier modulated signals, said signals comprising a plurality of symbols (200), each symbol being defined by phase differences between simultaneous carriers (202) having different frequencies, said apparatus comprising:

means for determining respective phases of the same carrier in different symbols;

means for eliminating phase shift uncertainties corresponding to codeable phase shifts from said phases to determine respective phase deviations;

means for determining a frequency offset by determining a phase difference between said phase deviations;

means for performing a feedback correction of said frequency deviation based on said determined frequency offset.

11. An apparatus for performing a fine frequency synchronization compensating for a carrier frequency deviation from an oscillator frequency, for a multi-carrier demodulation system (130) of the type capable of carrying out a differential phase decoding of multi-carrier modulated signals, said signals comprising a plurality of symbols (200), each symbol being defined by phase differences between simultaneous carriers (202) having different frequencies, said apparatus comprising:

means (330) for determining a phase difference between phases of the same carrier (202) in different symbols;

means (340, 342) for determining a frequency offset by eliminating phase shift uncertainties corresponding to codeable phase shifts from said phase difference;

means (344) for determining an averaged frequency offset ($f_{offset}$) by averaging determined frequency offsets of a

plurality of carriers; and

means for performing a feedback correction of said frequency deviation based on said averaged frequency offset.

12. An apparatus for performing a fine frequency synchronization compensating for a carrier frequency deviation from an oscillator frequency, for a multi-carrier demodulation system (130) of the type capable of carrying out a differential phase decoding of multi-carrier modulated signals, said signals comprising a plurality of symbols (200), each symbol (200) being defined by phase differences between simultaneous carriers (202) having different frequencies, said apparatus comprising:

means for determining respective phases of the same carrier in different symbols;

means for eliminating phase shift uncertainties corresponding to codeable phase shifts from said phases to determine respective phase deviations;

means for determining a frequency offset by determining a phase difference between said phase deviations;

means for determining an averaged frequency offset by averaging determined frequency offsets of a plurality of carriers; and

means for performing a feedback correction of said frequency deviation based on said averaged frequency offset.

13. The apparatus according to claims 9 or 11, wherein said means (330) for determining a phase difference comprises means for determining a phase difference between phases

of the same carrier in symbols which are adjacent in the time axis direction.

14. The apparatus according to claims 10 or 12, wherein said means for determining respective phases comprises means for determining respective phases of the same carrier in symbols which are adjacent in the time axis direction.

15. The apparatus according to claims 9 or 11, wherein said means (340, 342) for determining a frequency offset comprises a M-ary phase shift keying decision device (340) and a complex multiplier (342).

16. The apparatus according to claims 10 or 12, wherein said means for eliminating phase shift uncertainties comprises a M-ary phase shift keying decision device and a complex multiplier.

17. The apparatus according to one of claims 9 to 16, wherein said means for performing a feedback correction of said frequency deviation comprises a numerical controlled oscillator (322) and a complex multiplier (326).

18. The apparatus according to claim 17, wherein said means for performing a feedback correction of said frequency deviation further comprises a low path filter (324) preceding said numerical controlled oscillator (322).

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